Genetic Engineering And Enhancement. Gene Therapy And Transhumanism To Debate

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Introduction

After the early advances in molecular biology, scientists started to investigate about new techniques that could revoke genetic alterations by editing the patients' genome, also called **Genetic Engineering** (GE). Thus, the first method applied to humans was called **Gene Therapy** (GT), in 1990. However, in September 1999, a boy died because of the secondary effects of gene therapy. Then, governments started be more strict regulating clinical trials.

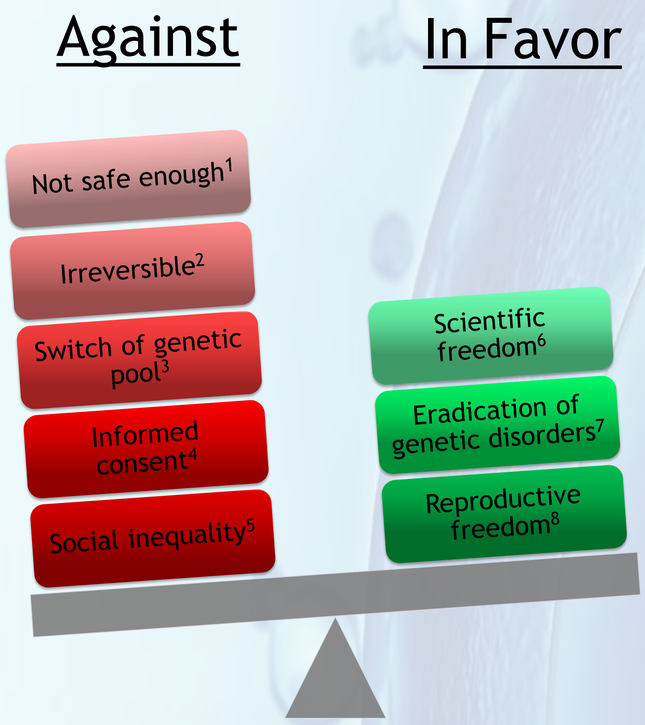
Given the potential of GE, healthy people could voluntarily change their own genetic code to improve some biological skills. The school of thought that supports this kind of GE applications is **Transhumanism** (H+)

Methodology & Aim

In this review, the most recent publications, either reviews or conventional articles related to gene therapy and transhumanism were studied. Firstly, a search of the terms *gene therapy, ethics, transhumanism* was held in Pubmed, Sciencedirect and ARE, and the articles found were ordered by adaptation and impact. Secondly, the most important articles were read and summarized, analyzing the bibliography. Finally, high-impact journals were periodically examined in the search of new publications. This method was made to achieve the following **objectives**:

1. Describe the different ethical opinions surrounding TG.
2. Treat different positions concerning GE as enhancer.

Should we use Gene Therapy?



(1) No sufficient data about side-effects

(2) When treatment is applied, genome is changed permanently → patients could suffer more than expected.

(3) Remove sequences that cause disorders → decrease in variability (Anti-Nature)

(4) In Germinal Gene Therapy (GGT), no informed consent would be signed by the developed individual

(5) High costs → discrimination by economical reasons

(6) The only way to improve knowledge is by investigating everything we want

(7) The most important potential benefit, overall by GGT

(8) For parents prone to genetic diseases, could be the solution → reduction of abortions

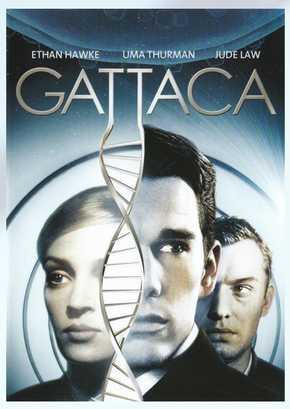


Figure 1. GATTACA (Andrew Nicol, 1997). *"I belonged to a new underclass, no longer determined by social status or the color of your skin. No, we now have discrimination down to a science" (Vincent Freeman)* . Obtained from http://goo.gl/NrKvgr

Should we use Gene Therapy as Enhancer?

Transhumanism is a cultural and intellectual school of thought that pursues the human condition's transformation by developing technologies which can improve humanity psychologically, physically and mentally.

Figure 2. Transhumanism symbol. Obtained from http://goo.gl/O3ZyF0

Against

- **Variability's end:** everyone would want the best memory, intelligence, immortality → Creation of **"ideal genome"** (Fig. 3)
- **Injustice:** high costs→ rich people who want to improve their skills will have the opportunity, while the poor cannot. It would lead to Discrimination similar to GATTACA (Fig. 1)
- Change of **embryos** without knowing which would be his will
- **Scission of humanity in two being kinds:** human and post-human

In Favor

- **Efficiency:** cultural and personal development could be refined
- **Freedom:** to enhance ourselves as we do now physically (make-up, tattoos...)
- **Assisted reproductive technology** → eugenic → enhancement has to be allowed too.
- **Evolution:** people immune to infectious diseases, senescence → suitable to the environment (Fig. 3)
- **Concept of normality:** *if therapeutics are morally allowed and there is no difference between treat and enhance, improvement has to be morally accepted* (sorites paradox)

Figure 3. Captain America, what somebody could become with enhancement techniques. Obtained from http://goo.gl/QUMnv4

Population concerns

A survey was made in USA and Canada about Gene Therapy uses. They obtained 470 valid responses.

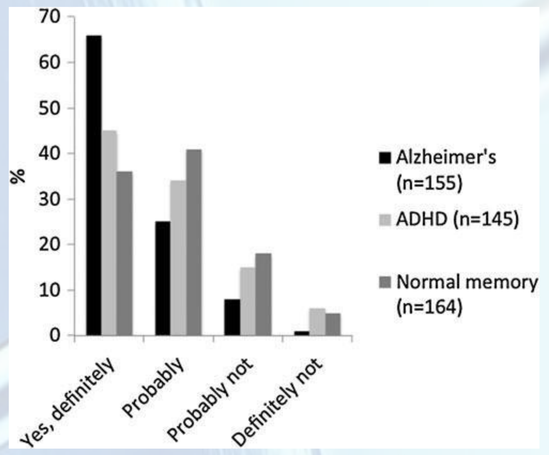


Figure 4. Acceptability of gene therapy for different applications, depending on three different conditions (1)

All of them were asked if GT use would be acceptable in different situations: Alzheimer disease, attention deficit hyperactivity disorder (ADHD) and normal memory enhancement (Fig. 4). Then they answered about acceptable enhancement forms(Fig. 5).

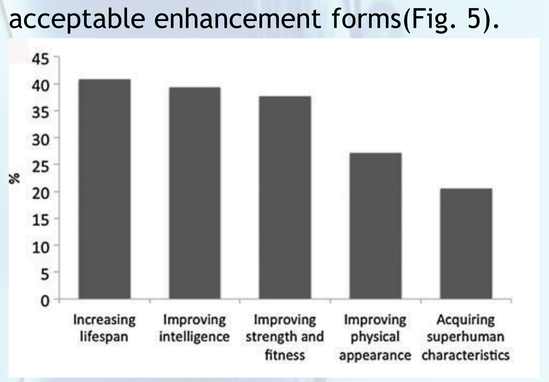


Figure 5. Acceptability of different enhancement forms. Percentage of acceptance of participants for five different forms (1)

The majority of participants accepted GT, being the acceptability greater as diseases are more severe. Most participants accepted GT for enhancement purposes.

China creates first genetically modified human embryos

In 2015 a Chinese research group created the first transgenic human zygotes (Fig. 6) with a technique called CRISPR/Cas9 to cure ß-thalassemia (2).

Due overall to the off-target mutations the technique provokes, results obtained show that GT is not safe enough to treat human species and further investigation is needed before application.

Figure 6. Tripronuclear zygote. It has 3 genome copies (discarded from clinical trials). Its edition has raised lots of ethical concerns around the world. Obtained from: http://goo.gl/fLhwn5

Conclusions

1. Further investigation is needed to ensure Gene Therapy is safe for the population before it is clinically applied.
2. More ethical debate has to be opened to agree about if Gene Therapy treatments should be used or not and to what purpose, since Genetic Engineering potential is widely greater than only cure.
3. Information about Genetic Engineering should be given to population, not only about the medical consequences but also about the social ones.
4. For American population it would be acceptable to use Gene Therapy to treat and to enhance people. More surveys have to be done in other countries.

References

1. Robillard JM, Roskams-Edris D, Kuzeljevic B, Illes J. Prevailing public perceptions of the ethics of gene therapy. Hum Gene Ther. 2014 Aug; 25 (8): 740-6
2. Liang P, Xu Y, Zhang Per, Ding C, Huang R, Zhang Z, et al. CRISPR/Cas9-mediated gene editing in human tripronuclear zygotes. Protein Cell. 2015 Apr 18; 6(5):363-72